Measurement of $\omega \rightarrow e^+e^-$ in $\sqrt{s_{NN}}$ = 200GeV Nucleus + Nucleus collisions at RHIC-PHENIX

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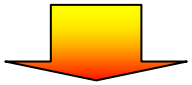
OUTLINE

- motivation
- method
- real data analysis
  - comparison of invariant mass spectra between Au+Au and p+p collisions
  - reproduction of combinatorial background
  - invariant mass spectral
- result
  - dN/dy
  - invariant pT slope
- conclusion & outlook

motivation

Deconfined partonic phase is expected to be created in the high energy heavy ion collisions at RHIC.



Under high temperature created deconfined partonic phase, mass of vector mesons may be modified due to effect of chiral symmetry restoration.

Are mass modification of vector mesons able to be observed at heavy ion collisions?

～ **life time** ～

deconfined partonic phase : : ~10fm/c

ω : : 23fm/c

ϕ : : 46fm/c

→ ω has shorter life time than ϕ

→ higher probability of decay in deconfined phase

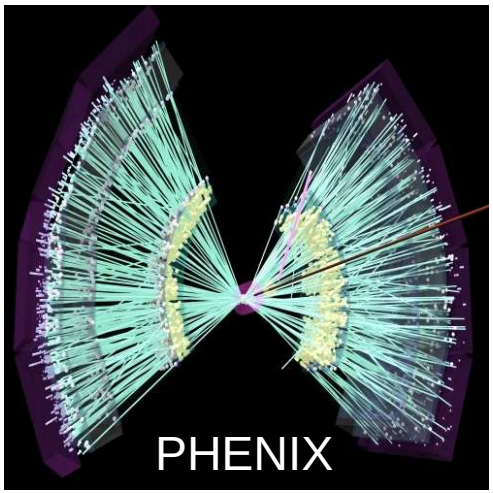
－**existence of decay mode to lepton pair** －

electrons do not interact strongly with medium.

electrons carry the information from the deconfined partonic phase.

analysis of ω via di-electron in Au+Au collisons

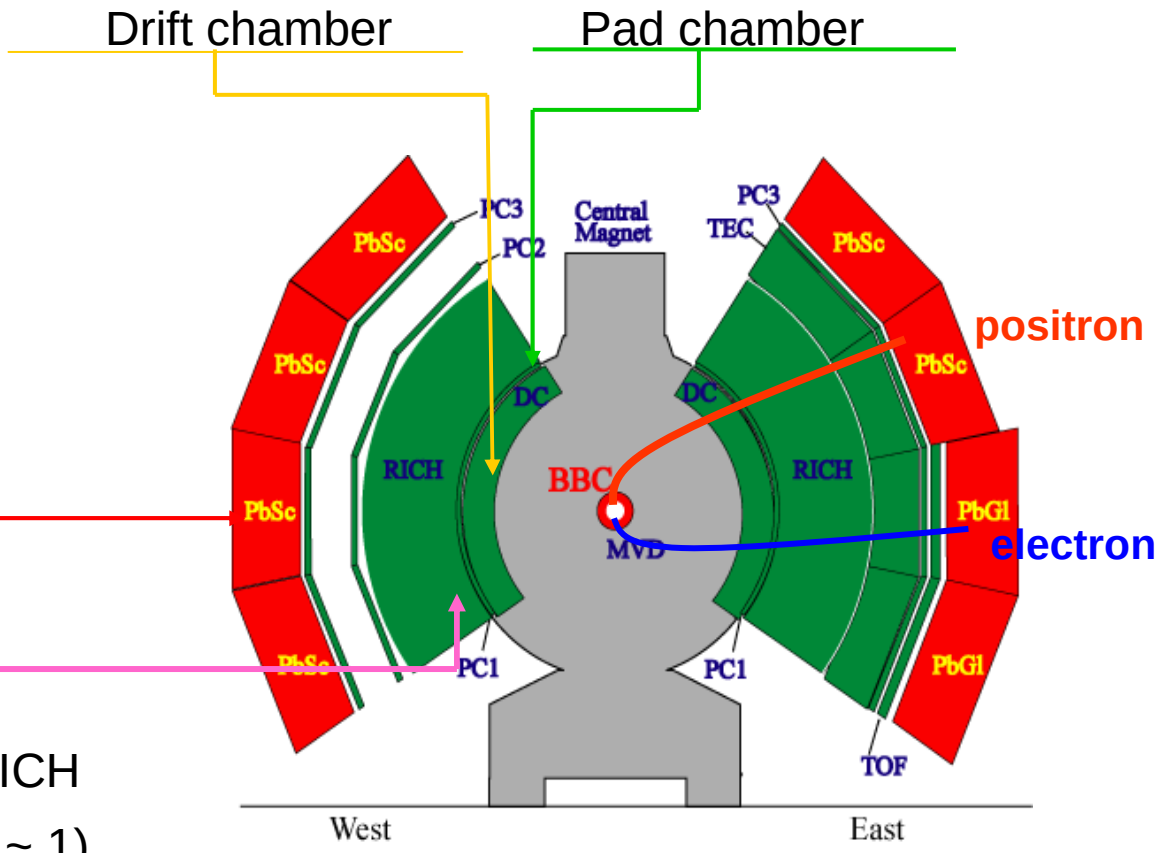
method



$\sqrt{s_{NN}} = 200GeV \ at \ AuAu \ collisons$

Tracking charged particle

→ calculating momentum of each track



electron identification

RICH ＋ EMC（PbSc,PbGl）

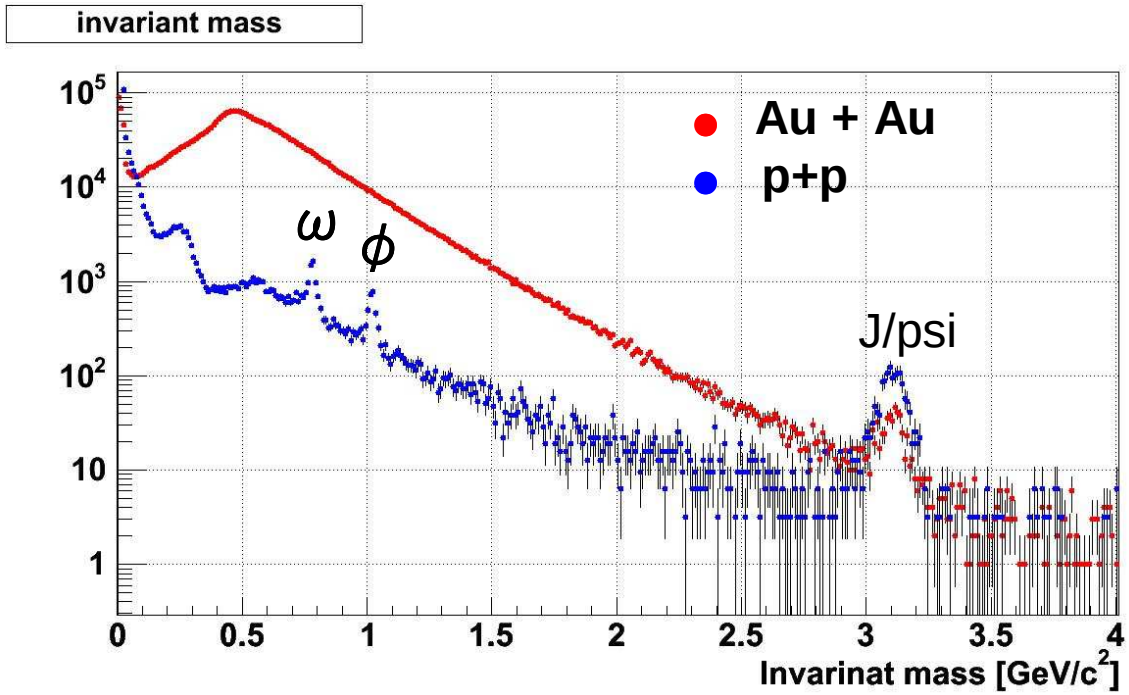
－Identification of electron

momentum<4.9GeV/c by RICH

－Energy deposit into EMC (E/p ~ 1)

Identified electron pair are Reconstructed.

comparison of invariant mass spectral (Au+Au, p+p)



N_{coll}
- 1 (p+p)
- 257.8 (Au+Au Min Bias)

Normalized invariant mass distribution of p+p collisions by N_{event} and N_{coll}

p + p collisons

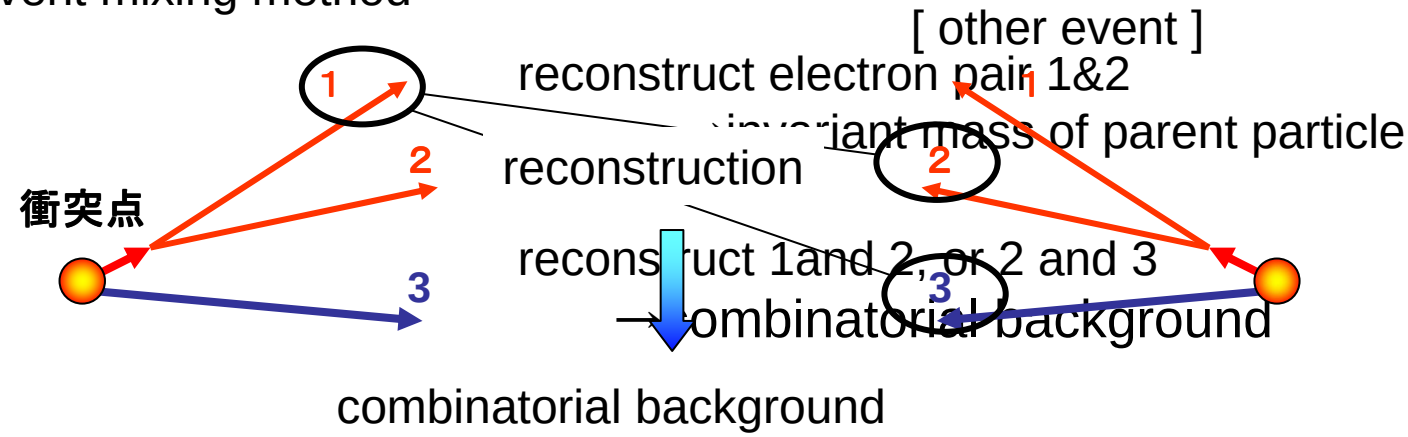
We can see clear ω and ϕ peak.

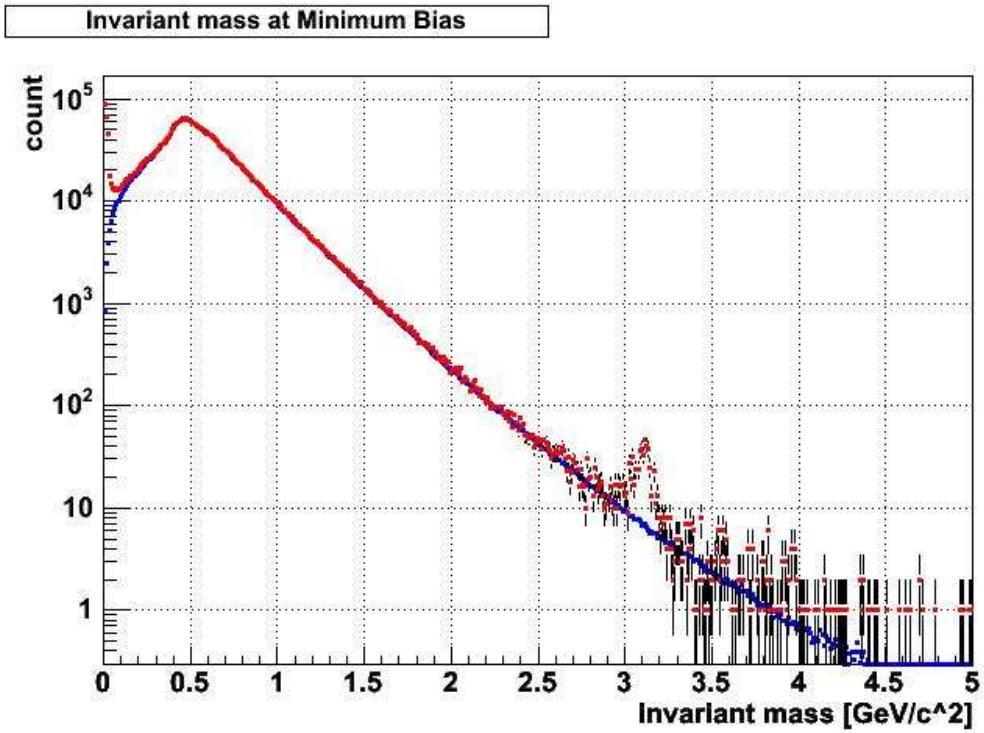
Au + Au collisions

large combinatorial background due to large multiplicity

reproduction of combinatorial background

~ event mixing method ~





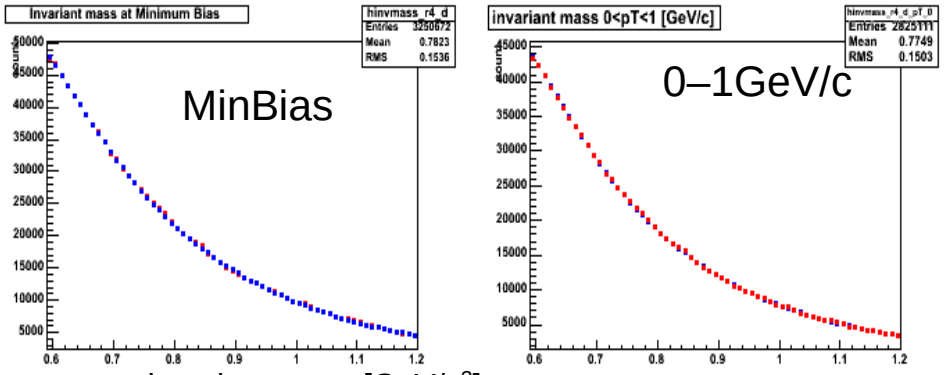
- Foreground
- combinatorial background

reproduced by event mixing method

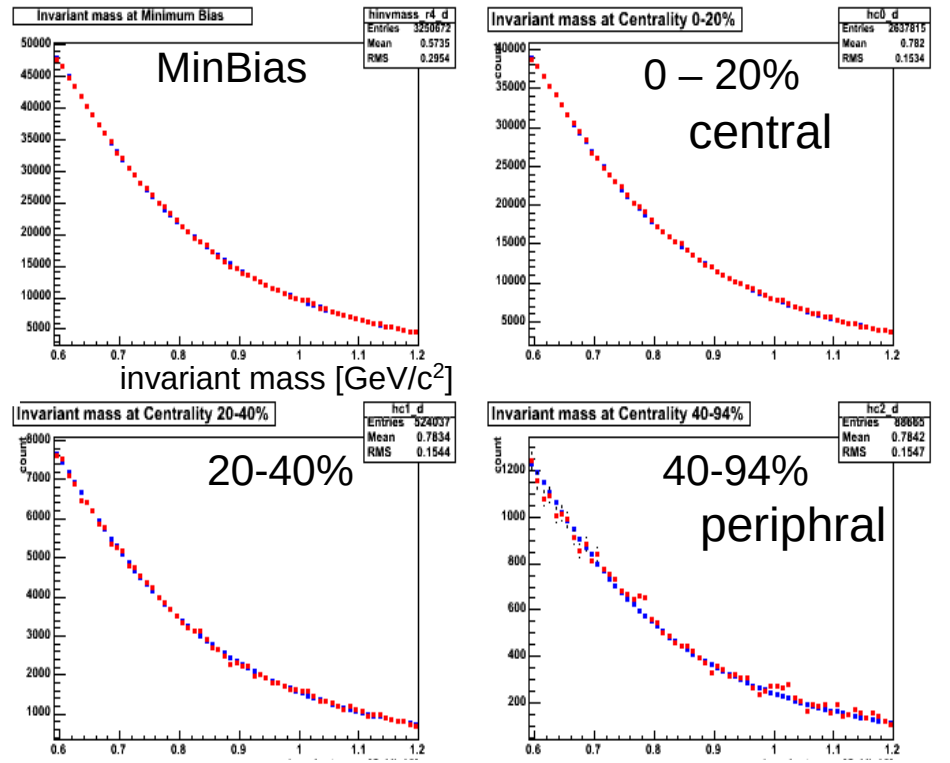
invariant mass (0.6 – 1.2 GeV/c²)

Red point : foreground
Blue point : mixing event

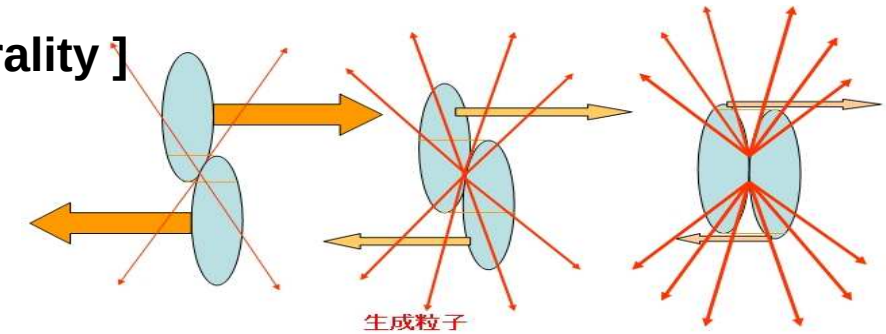
pT



centrality

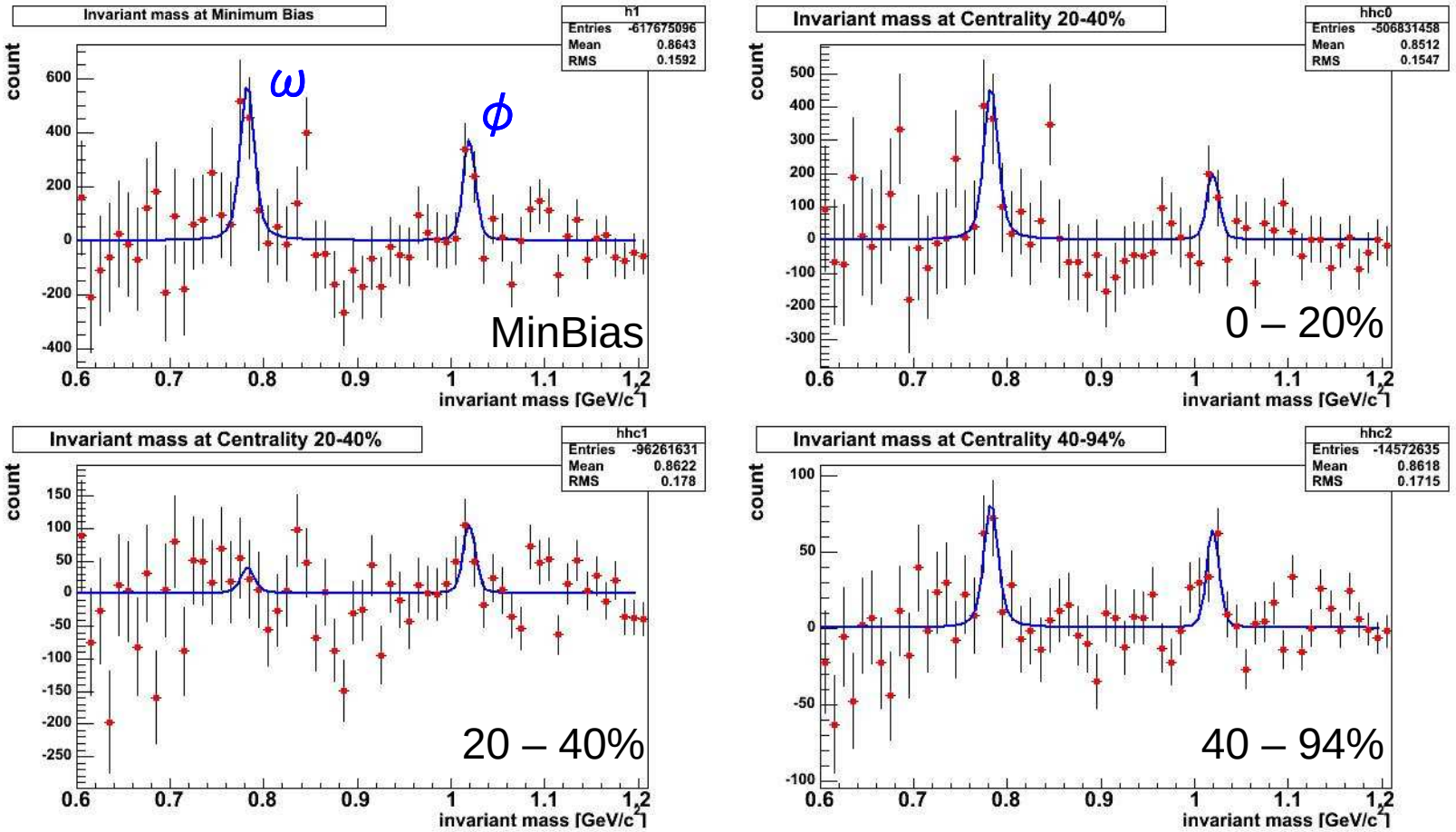


[centrality]



invariant mass（centrality）

Foreground – combinatorial background

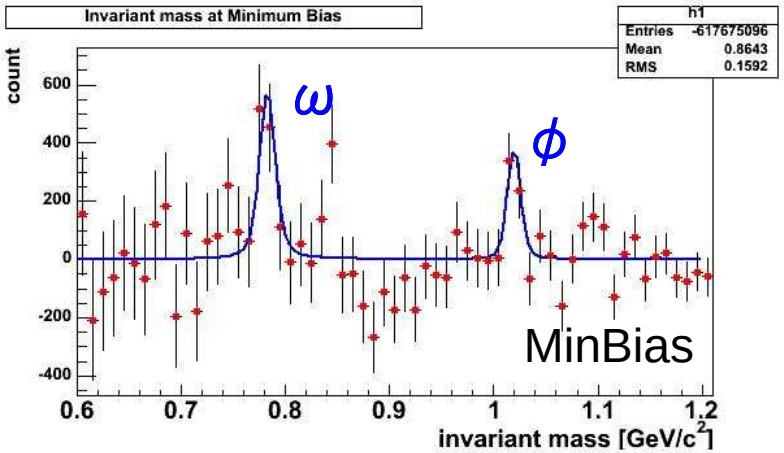


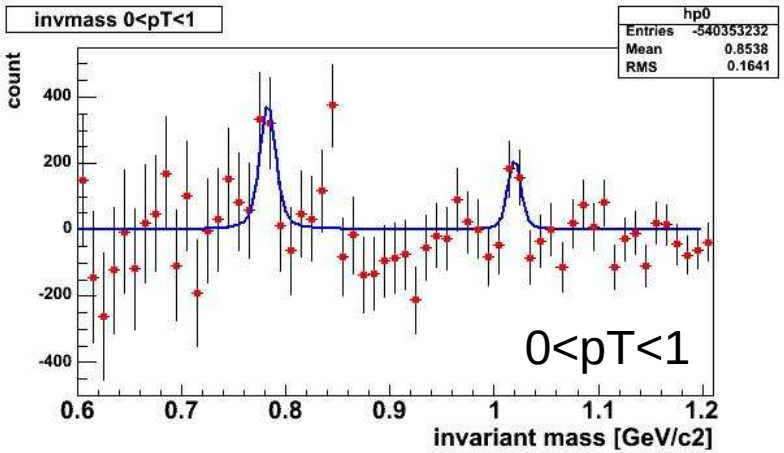
Fitting function is Gaussian convoluted Breit-Wigner .

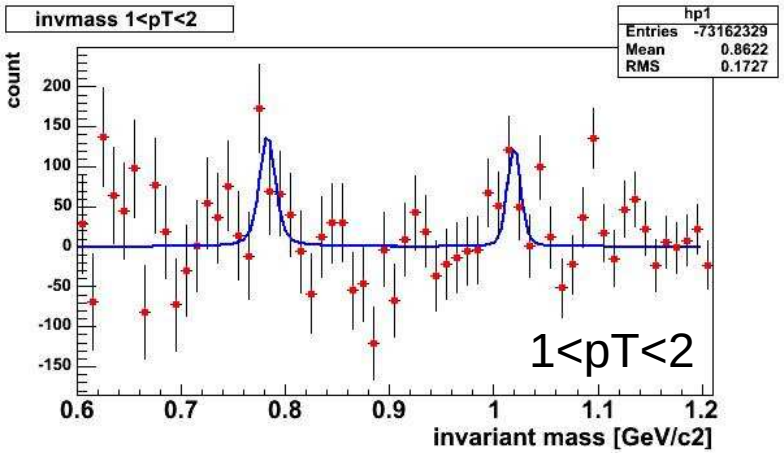
Fixed
- mass center = 782.57MeV
- mass width = 8.44MeV
- σ_{exp} = 5.6MeV

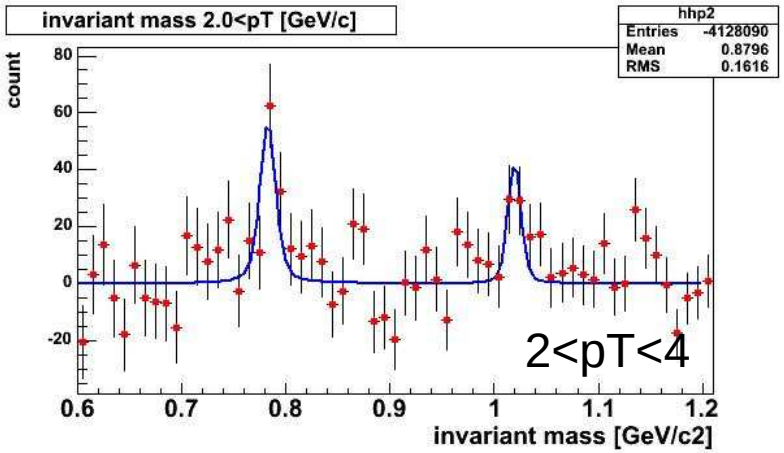
invariant mass（pT）

Foreground – combinatorial background









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Fixed
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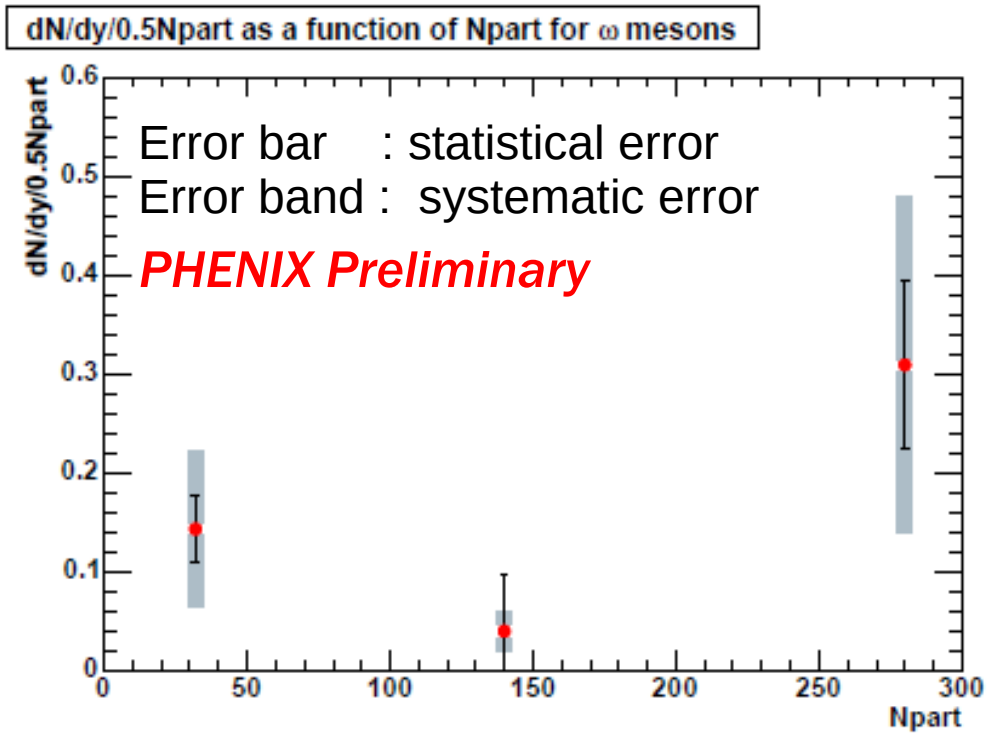
Result (dN/dy)

$$\frac{1}{0.5\ N_{part}}\frac{dN}{dy} = \frac{1}{0.5\ N_{part}}\frac{N_{omega}}{dy \cdot Nevent \cdot efficiency \cdot branching\ ratio}$$

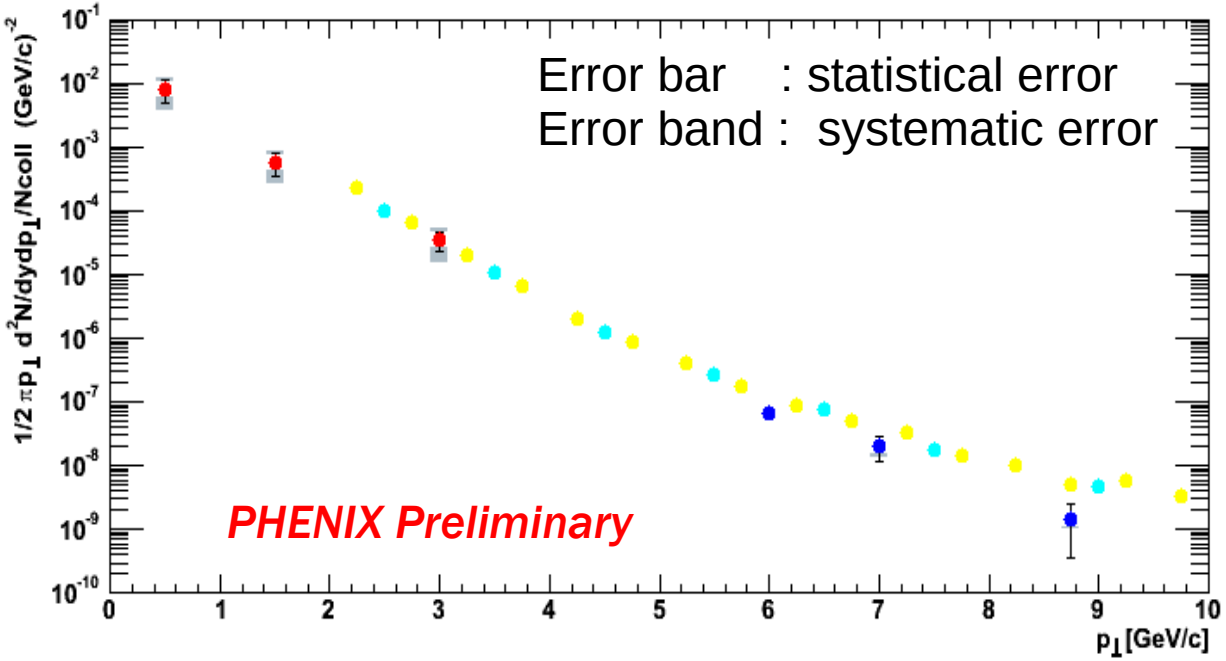
Efficiency is calculated by simulation (Exodus,PISA）



dn/dy is scaled in error

Result (invariant pT slope)

$$\frac{1}{2\pi P_T}\frac{dN}{dp_T dy \cdot N_{coll}} = \frac{1}{2\pi\, p_T \cdot N_{coll}}\frac{N_{omega}}{N_{event} \cdot \Delta p_T \cdot efficiency \cdot breanching\ ratio}$$



- **Au+Au → ω → e⁺e⁻**
- **Au+Au → ω → π⁰γ**
- **p+p → ω → π⁰π⁺π⁻**
- **p+p → ω → π⁰γ**

consistent with

- $\pi^0\gamma$ decay channel at Au+Au collisions
- $\pi^0\gamma$ 、$\pi^0\pi^+\pi^-$ decay channel at p+p caollisions

Conclusion

- extracting signal of omega meson at Au+Au collisions at RUN4 is succeeded.

- invariant pT slope of omega meson from electron decay mode is consistent with other decay channel and p+p collision system.

outlook

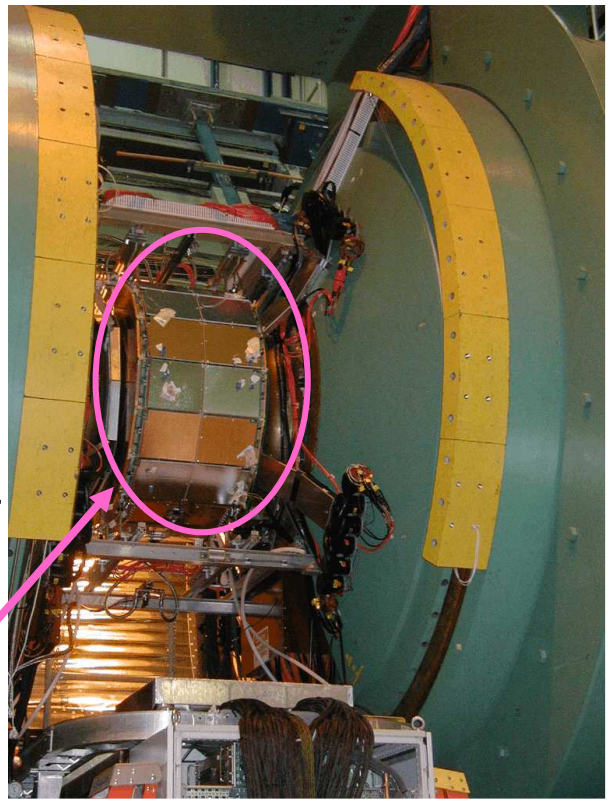
～combinatorial background sources ～

electrons from decay of π^0 and photon conversion

Hadron Blind Detector is installed at RUN7

HBD will has capability to measure low mass electron pair from decay of π^0 and photon conversion

→ reduce of the background by a factor 100



Hadron Blind Detector